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Cultivated Grasses OF SECONDARY IMPORTANCE



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THE GRASSES discussed in this bulletin are mostly of secondary agricultural importance in the United States. Important cultivated grasses are the subject of another Farmers' Bulletin (No. 1254). Each of the 19 grasses here described is illustrated, its range of adaptation or use is shown by a map, and agronomic and botanical information concerning it is given. This will indicate to the reader the grasses that are likely to be of value in his section of the country.

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CULTIVATED GRASSES OF SECONDARY IMPORTANCE

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THE GRASSES herein described and illustrated are all of some agricultural or horticultural value in the United States. Not one of them is of outstanding importance except in a limited area. Some of them are sure to reach greater economic importance as they become better known and their value is more appreciated.

All of the grasses herein described, except slender wheatgrass, were introduced from some other country. All of the grasses of the highest importance in the United States discussed in a pre-

vious bulletin (see Farmers' Bulletin 1254, "Important Cultivated Grasses") are from some other region than the United States, and with one exception all are natives of the Old World. Just why introduced grasses succeed under cultivation so much better than native grasses is one of the mysteries of nature. Probably there are secrets concerning our native American grasses not yet unraveled. Some of them are admirable in respect to growth, texture, and palatability, but they seem unable to hold the ground against more aggressive alien species.

BROMEGRASS

Bromegrass (*Bromus inermis* Leyss; fig. 1) is also known as Hungarian brome, smooth brome, awnless brome, Russian brome, and Austrian brome. It is native from central Europe to China. The earliest cultivation reported was in 1769 as a pasture grass, but except in Hungary and Russia it never attained much importance in Europe. It was first introduced in the United States about 1884 and soon met with high favor as a grass for the drier farming regions of the West (fig. 2). The most extensive culture is in the Dakotas, Montana, and western Canada, but since 1910 the acreage in this grass has probably not increased.

Bromegrass is best adapted to regions of rather light rainfall and low or moderate summer temperatures. It has never succeeded so well in the East as in the West. The best growth is made on clays or clay loams, but it succeeds fairly well in sandy soils. The roots penetrate 5 to 6 feet into the soil. No

other cultivated perennial grass except crested wheatgrass withstands drought conditions so well. Even in the most severe winters no injury from the cold seems to occur. Bromegrass is usually sown in spring on well-prepared land, using from 10 to 20 pounds of seed per acre. The yield of hay the first year is usually small, good the second year, and best the third. Thereafter the yields decrease markedly unless the fields are specially treated. The yield of hay ranges from 1½ to 3½ tons per acre. Where the higher yields are secured two cuttings are made in a season.

After the third year bromegrass is said to become sod-bound. By loosening the soil the yields will be increased. This may be done by plowing the grass shallow in spring or in fall, by plowing deeper in spring and sowing oats, or by plowing in fall and sowing small grain. In all cases the grass is markedly invigorated.



FIGURE 1.—Bromegrass (*Bromus inermis* Leyss) : 1, Plant, showing habit (about one-fifth natural size) ; 2, a panicle (somewhat reduced) ; 3, spikelet (much enlarged).

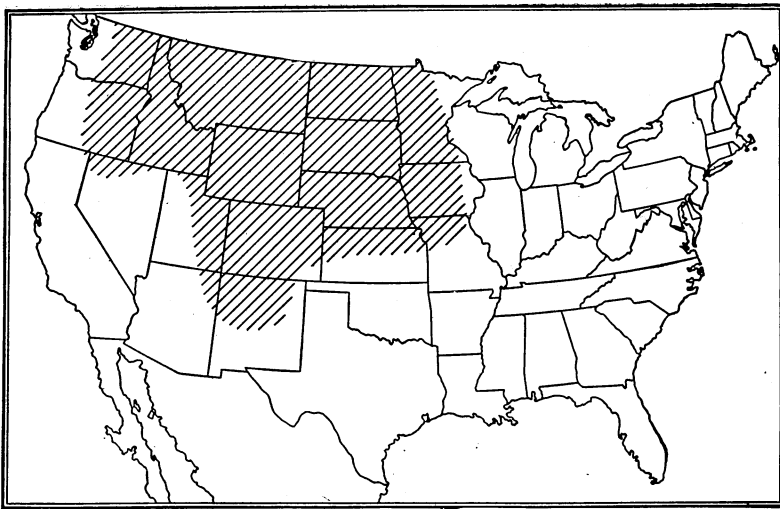


FIGURE 2.—Region of the United States in which brome grass is most valuable.

Brome grass is also excellent for pasture, being one of the most palatable of all grasses. It is really more valuable thus used than for hay, but it will not pasture so many animals as does sweet-clover. Sometimes it is mixed with sweet-

clover for pasture.

Seed is produced in the Dakotas and western Canada. Yields are from 250 to 600 pounds per acre. A bushel weighs from 10 to 20 pounds. One pound contains about 137,000 seeds.

SLENDER WHEATGRASS

Slender wheatgrass (*Agropyron pauciflorum* Hitchc.; fig. 3) and reed canary grass are the only native American grasses that have become cultivated crops. In Canada slender wheatgrass is called western ryegrass and McIvor's ryegrass.

This grass occurs as a native from New Mexico to Alaska and Manitoba and eastward to Pennsylvania and Newfoundland, but is most abundant in the interior regions of the West (fig. 4). It is a very variable grass in different parts of its range, and some of the forms are doubtless more valuable than others for cultivation. Slender wheatgrass grows in dense bunches or tufts, sometimes 1 foot in diameter, with numerous erect stiff flowering stems 2 to 4 feet high. The flower cluster is narrow and rather dense, 2 to 4 inches long, not unlike a head of wheat, but much more slender. While typically a bunch of grass, it may form rootstocks under favorable conditions. Over considerable areas it is a very valuable range grass, growing most abund-

antly in the alluvial lands along streams and only occasionally on the higher bench lands. It does not persist, however, on river bottoms that are occasionally flooded. It is notable for its ability to grow in alkali lands where most other grasses fail.

This grass was first cultivated about 1895 and is now grown most abundantly in Manitoba, Alberta, Saskatchewan, and the Dakotas. From the results of numerous experiments it seems to be the best perennial grass known that is adapted to dry-land conditions, with the exception of Hungarian brome grass. The hay should be cut when the seeds are in the early dough stage. If the grass is allowed to become older before cutting, the hay is not so palatable. Ordinarily the yield of hay is $1\frac{1}{2}$ to 2 tons per acre, but occasionally it is as high as 4 tons. Sometimes a second small cutting is obtained. At Guelph, Ontario, slender wheatgrass gave the highest yields of hay of 15 grasses tested for 6 years. The grass is late in maturing, even later than timothy.



FIGURE 3.—Slender wheatgrass (*Agropyron pauciflorum* Hitchc.): 1, Plant, showing habit (about one-fourth natural size); 2, a single spike (somewhat enlarged); 3, spikelet (much enlarged).

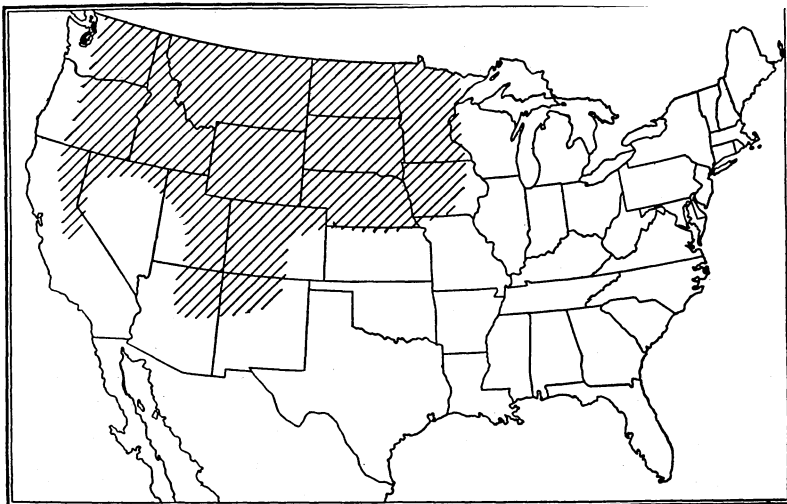


FIGURE 4.—Region of the United States in which slender wheatgrass is most valuable.

In Saskatchewan mixtures of slender wheatgrass with alfalfa and with red clover proved very satisfactory.

Slender wheatgrass may be sown alone, but usually succeeds well if sown with a crop of wheat or oats. Different authorities have advised as low as 10 pounds and as high as 35 pounds of seed per acre. In Ontario splendid results are obtained with 15 pounds sown in spring with a grain crop. In Wyoming 35 pounds per acre gave a good stand. Fall sowing in Saskatchewan at the rate of 15 pounds per acre produced a fine stand that survived the winter perfectly. It is prob-

able that a higher rate of seeding is desirable where the conditions are not very favorable.

Seed is produced in abundance and easily harvested. Most of it is produced in Canada. There are apparently no recorded data as regards the yield of seed, which weighs about 20 pounds to the bushel.

Slender wheatgrass is very variable, the numerous forms being very different one from another. Perhaps in no other native grass is there better opportunity for selection in order to obtain the best form for each section where it is adapted.

JOHNSON GRASS

Johnson grass (*Sorghum halepense* (Linnaeus) Persoon, *Andropogon halepensis* (Linnaeus) Brotero, *Holcus halepensis* Linnaeus; fig. 5) is a native of the Mediterranean region from the Madeira Islands to Asia Minor and southeastern Europe. Closely related forms occur in India, the Malay Peninsula, and the Philippines. The grass was first described from specimens collected at the city of Aleppo, whence the specific name.

The grass was introduced from Turkey into South Carolina about 1830. The seeds were brought back by a planter whom Governor Means had sent to instruct the Turks in cotton culture, for

which reason the name Means grass still is used in South Carolina. It gets its present common name from Col. William Johnson, who grew it extensively at Selma, Ala., beginning about 1840. Other common names that have been used are Aleppo grass, racehorse grass, false guinea grass, and evergreen millet.

Johnson grass is now widespread in the United States, being found across the continent northward to Virginia, Oklahoma, and northern California. Farther northward it occurs occasionally but does not persist, being destroyed in severe winters. In the West it is grown mainly in irrigated areas. In the North



FIGURE 5.—Johnson grass (*Sorghum halepense* (Linnaeus) Persoon, *Andropogon halepensis* (Linnaeus) Brotero, *Holcus halepensis* Linnaeus): 1, Plant, showing habit of forming creeping rootstocks (about one-sixth natural size); 2, a panicle (about natural size); 3, branch with one fertile and two sterile spikelets (somewhat enlarged); 4, fertile spikelet seen from the ventral side (much enlarged).

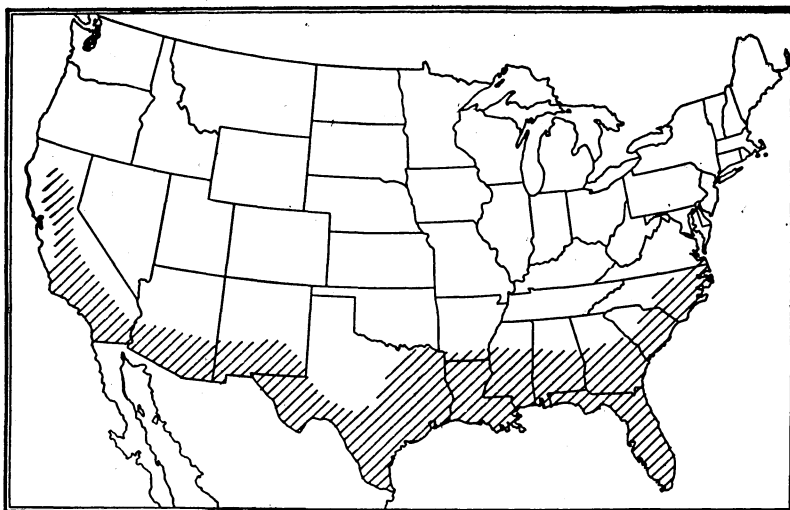


FIGURE 6.—Region of the United States in which Johnson grass is perennial.

it can be utilized only as a summer crop, as nearly every winter the plants are killed (fig. 6).

While Johnson grass has merit as a forage plant, the difficulty of eradicating it has given the plant an unenviable reputation as a weed. It is emphatically a rich-land plant and on poor soils rarely proves objectionable as a weed. Large areas of rich land, particularly river bottoms, the black lands of Alabama and Mississippi, and the richer lands of Texas, are now heavily infested with it.

On some of these lands Johnson grass is utilized as a crop. A common practice is to grow a winter crop of oats or oats and vetch, after which two or sometimes three crops of Johnson grass can be cut for hay. The hay is considered to be of good quality, but the fear of the grass as a weed greatly limits its market.

The weedy habit of Johnson grass is due to its long underground stems, or rootstocks, which may penetrate the soil 2 or 3 feet deep. When constantly pastured or cut frequently for hay the rootstocks do not grow much and consequently are not far below the surface. In this condition it is more easily destroyed

by shallow plowing followed by frequent harrowing, especially in dry hot weather. When constantly mowed or pastured Johnson grass apparently disappears, but if the land is plowed an abundant growth often appears from the dormant rootstocks.

Johnson grass can scarcely be said to be a cultivated grass, but many farmers prefer utilizing it as forage to fighting it as a pest. Once established it persists indefinitely, especially if the land is plowed each year. If this is not done the crops of Johnson grass become very small. Sometimes fields are plowed up in winter so that the hogs can eat the rootstocks, of which they are fond.

Some seed of Johnson grass is harvested, especially in Texas, but the demand for it is small.

Johnson grass is the most striking example in America of a plant purposely introduced which has become a pest, and it emphasizes the need of care in testing a plant thoroughly before it is distributed to farmers. Even though it possesses forage qualities of merit, Johnson grass can scarcely be considered an asset.

BIRDGRASS, OR ROUGH-STALKED BLUEGRASS

Birdgrass (*Poa trivialis*. Linnaeus; fig. 7) is a native of northern Europe and one of the abundant and valued pasture

grasses of that region. It was early introduced into the United States, probably in mixed seeds, and now occurs generally



FIGURE 7.—Birdgrass, or rough-stalked bluegrass (*Poa trivialis* Linnaeus): 1, Plant, showing habit (about one-third natural size); 2, a panicle (about natural size); 3 and 4, spikelets (much enlarged); 5 and 6, florets, showing the long tuft of hairs at the base of each lemma (much enlarged).

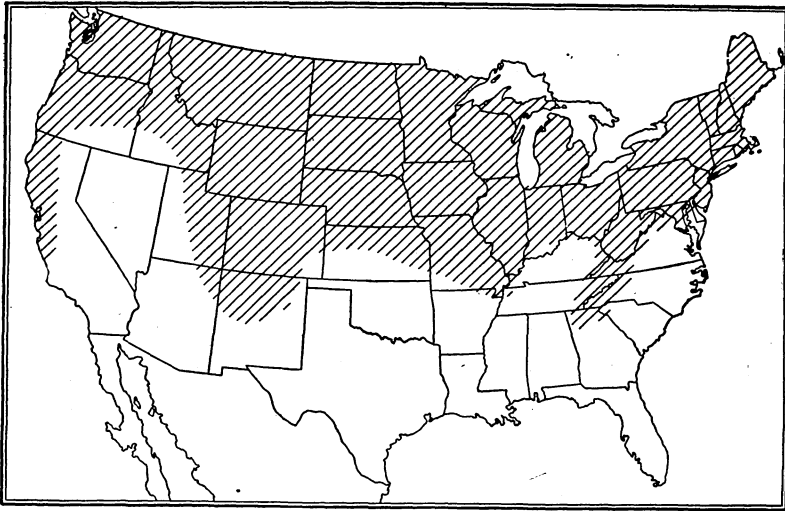


FIGURE 8.—Region of the United States to which birdgrass is adapted. It does best in the northern tier of States.

from the Atlantic to the Pacific. It is common southward as far as Virginia and Missouri and sometimes is found in shady places farther south.

Birdgrass is best adapted to cool, moist soils. In shady places it thrives better than any other turf grass and makes exquisite lawns. During the hot weather of midsummer the grass suffers severely and apparently disappears in open places, but again grows actively with the coming of fall. In Canada and the northern tier of States it remains green all summer; farther southward it becomes dormant in midsummer, except in shady places (fig. 8).

Birdgrass spreads by stolons or creeping branches on the surface of the ground. Unlike Kentucky bluegrass, a near relative, it has no underground stems. The leaves are apple-green in color, giving a very pleasing effect. Even in severe winter weather the leaves

remain bright green, while Kentucky bluegrass leaves become very dull in color.

Birdgrass is a very valuable pasture grass northward, especially on moist lands. It should be much more generally used, though it seems to be spreading rapidly by purely natural means. For shady lawns it is far superior to any other grass. In Europe it has been called the "queen of the pasture grasses." The peculiar green color of northern European lawns and pastures, so different from that of Kentucky bluegrass, is largely due to the abundance of birdgrass.

Seed is produced in abundance in Europe, mostly in Denmark. One bushel weighs about 18 pounds. For use on pasture it is best combined with other grasses. On lawns it should be sown at the rate of 5 pounds to 1,000 square feet.

CREEPING BENT

Creeping bent (*Agrostis palustris* Hudson; fig. 9) is a valuable grass for lawns, pastures, and haymaking. Unfortunately, it became much confused with redtop and with Rhode Island bent both in botanical and in agronomic writings. From these it is easily distinguished by its dense panicle and by its creeping stolons or runners, which may grow as much as 4

feet long in a season. It is native to Europe, but perhaps the coarser seashore form known as seaside bent (*Agrostis maritima* Lamarck) is native on the Atlantic coast of America (fig. 10). This last is somewhat coarser than ordinary creeping bent, and the seeds are slightly different.

Creeping bent is most esteemed for the



FIGURE 9.—Creeping bent (*Agrostis palustris* Hudson) : 1. Portion of a plant, showing habit ; note the creeping stolons, which root at the nodes (about one-third natural size) ; 2, a spikelet (much enlarged) ; 3, ligule (much enlarged).

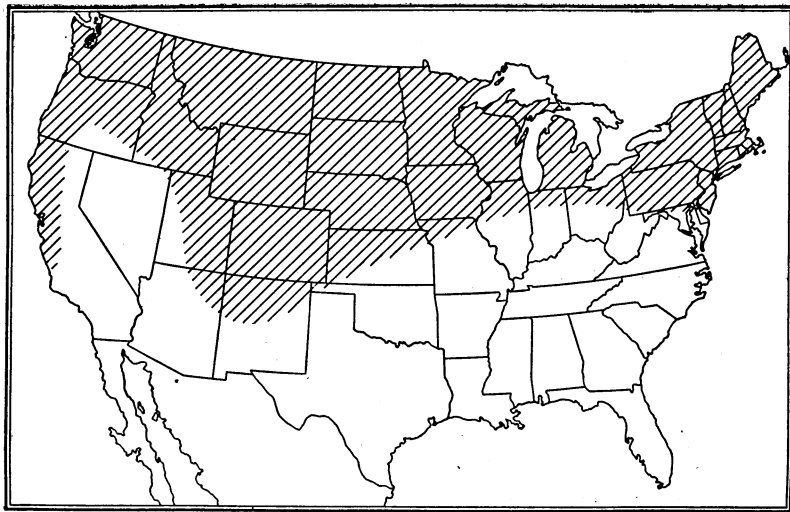


FIGURE 10.—Region of the United States in which creeping bent will thrive. In the drier areas it needs irrigation.

beautiful fine turf it produces, superior to all other temperate grasses with the exception of velvet bent. On old lawns a single plant of creeping bent often makes a circular mat 3 feet or more in diameter. If a small piece of runner 2 or 3 inches long is planted in early fall in good ground, there will result at the end of 12 months a circular mat of grass 6 to 8 feet in diameter. This mat is composed of innumerable runners that radiate in all directions from the piece planted. These runners are composed of joints an inch or less long, each of which, if planted, will give rise to a new plant. By chopping up the runners into the joints and planting these a lawn of pure creeping bent can be established, uniform in color and texture. There are many strains of the grass, bluish to green and coarse to very fine.

Creeping bent is also valuable agriculturally. In many places it is common in pastures. On both the Atlantic and Pacific coasts large areas occur in seaside meadows, which are used both for hay and pasture. Inland the grass succeeds equally well, especially if the soil is fairly moist. Over 100 years ago seaside bent was exploited in Ireland by Dr. William Richardson under the name of florin. In many parts of the United States the grass justifies the high praise given it by Richardson. Confusion of the grass with redbtop is partly the cause of florin being neglected.

Commercial seed is now available of the special strains known as "Seaside bent" and "Cocoos bent." This seed, weighing about 38 pounds per bushel, is too expensive except for golf courses and lawns.

PROSO, OR BROOMCORN MILLET

Proso (*Panicum miliaceum* Linnaeus; fig. 11), also called hog millet and broomcorn millet, is a plant cultivated since prehistoric times for human food. It is the "common millet" of Europe and the milium of the ancient Romans. It is probably native to central Asia and in all likelihood was first cultivated there.

Proso is readily distinguished from the foxtail millets, as the flowers are in branching panicles and there are no awns

to the florets. There are numerous varieties, varying in the looseness or density of the panicle and in the color of the chaff and seeds. The last may be white, yellow, red, brown, or black.

Proso is still largely cultivated in Europe, especially Russia, principally for the grain to be used as food. In America it is grown mostly in the Dakotas, Montana, and adjacent Canada, partly as a grain crop, partly for hay (fig. 12). The



FIGURE 11.—Proso (*Panicum miliaceum* Linnaeus): 1, Complete plant, showing habit (about one-third natural size); 2, a single panicle (about natural size); 3, dorsal view of spikelet (much enlarged); 4, ventral view of spikelet (much enlarged); 5, a single grain (much enlarged).

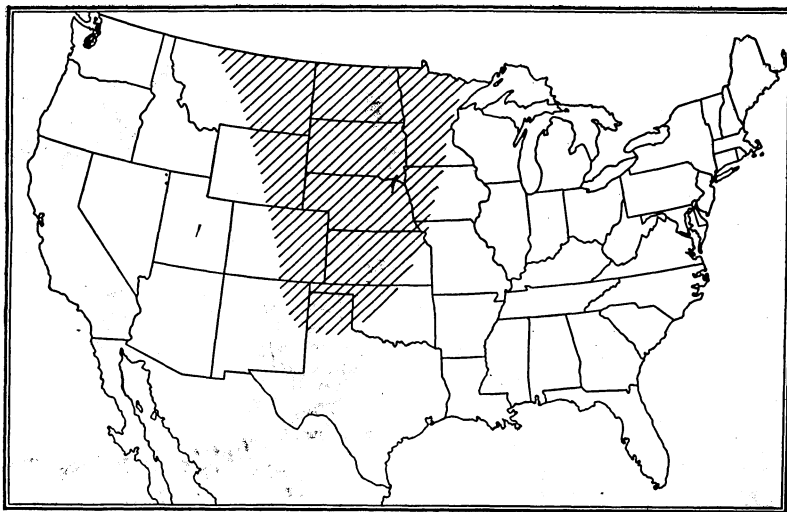


FIGURE 12.—Region of the United States to which proso is best adapted.

hay is considered hardly as desirable as that of foxtail millet, being more fibrous and less leafy. The yields, too, are smaller, ranging from 1 to 1½ tons per acre.

Proso is mainly grown as a catch crop on land where other crops fail. It will mature about 2 weeks earlier than foxtail millet when sown at the same time.

It yields fairly large seed crops, commonly 10 to 30 bushels per acre and rarely 60 bushels. The seed is mostly used as feed, but should preferably be ground. It is good feed for hogs and poultry.

Proso seed well cleaned weighs 56 pounds per bushel. In sowing, from 15 to 40 pounds per acre are used.

REED CANARY GRASS

Reed canary grass (*Phalaris arundinacea* Linnaeus; fig. 13) is native to the northern part of both hemispheres. It is a very variable grass usually found growing in wet places. A well-known variety is the familiar ribbon grass of the gardens. Although naturally a grass of moist or wet land, often on river or lake banks subject to periodic overflows, it succeeds splendidly on high well-drained land even in regions of rather low rainfall. In its broad relations to moisture it is not unlike redtop.

Reed canary grass is a coarse species, growing 4 to 7 feet tall, but the leafy stems are stout and never lodge. The grass tends to grow in bunches 2 or 3 feet in diameter, but it spreads underground by creeping branches or rootstocks. The flowers are in dense cylindrical clusters 3 to 6 inches long, and the seeds shatter promptly when ripe.

The cultivation of this grass began in 1824 in England and in 1850 in Germany. Some commercial seed of European origin is on the market, but its price is high. If it were not for its poor seed habits and the consequent costliness of the seed, the grass would undoubtedly be much grown. In spite of this handicap its culture is becoming enlarged, especially in the Pacific Northwest (fig. 14).

The grass is very palatable both as hay and as pasturage. Though the hay is coarse it is eaten cleanly. Yields of 6 to 9 tons per acre are reported, but these are very exceptional. One Oregon farmer writes that a field of 6 acres supported 27 dairy cows and 2 calves from April 3 to August 4—over 4 cows to the acre. In addition to the pasturage, each cow received 8 pounds of rolled barley per day.

It is one of the earliest grasses to be-

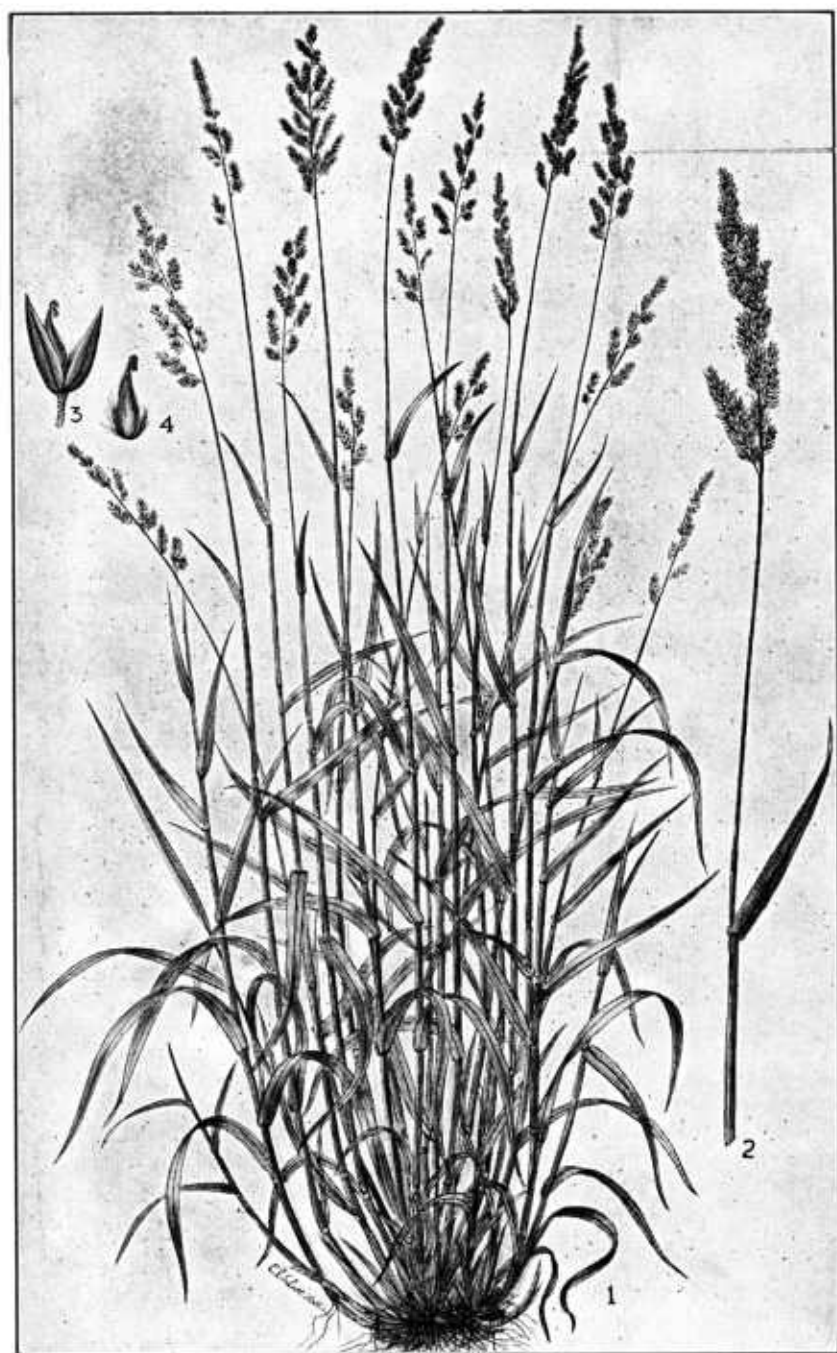


FIGURE 13.—Reed canary grass (*Phalaris arundinacea* Linnaeus): 1, Plant, showing habit (about one-sixth natural size); 2, a panicle (slightly reduced); 3, floret (much enlarged); 4, single spikelet (much enlarged).

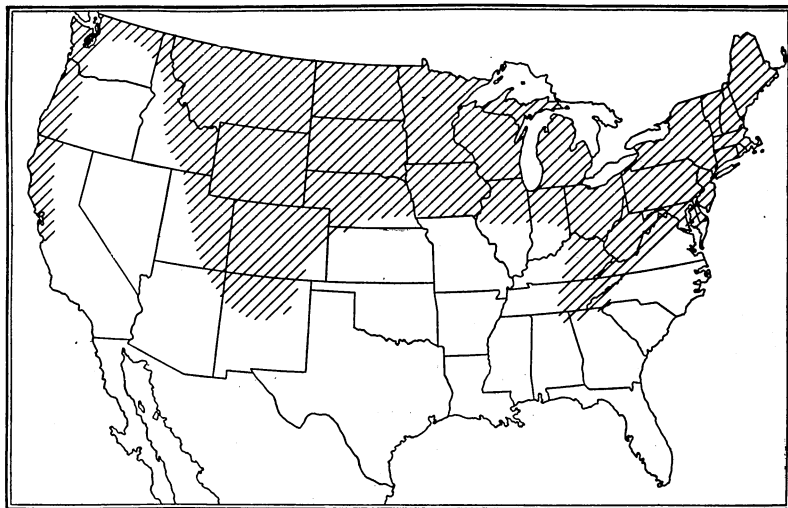


FIGURE 14.—Region of the United States to which reed canary grass is adapted.

gin growth in the spring and will withstand pasturing well if not too closely grazed or pastured too long continuously.

Some seed is now being produced in Oregon and meets ready sale there. The seed weighs 44 to 48 pounds per bushel.

RESCUE GRASS

Rescue grass (*Bromus catharticus* Vahl; fig. 15) is also known under various other names, including Schrader's brome-grass, Schrader's grass, Australian brome, Australian oats, southern chess, and sometimes arctic grass; in Australia prairie grass is the usual name. Another botanical name used for it is *Bromus schraderi* Kunth. It has commonly been called *Bromus unioloides*, but this name belongs to a different grass.

This grass is, with little doubt, a native of South America and is particularly abundant in Argentina and Uruguay. It was first described in 1806 from specimens sent to Berlin from Carolina. In 1853 it was advertised with high praise by B. V. Iverson, of Columbus, Ga., who gave it the name rescue grass. Since then the seed has been handled in the trade, and the grass is of some agricultural importance. In many sections of the United States, especially in the South and in the humid parts of the Pacific coast, it is naturalized. It is of increasing importance in South Africa. Agricul-

turally it is most important in Australia, where it is much grown and from whence comes most of the seed supply. The seed is relatively cheap and as a rule of excellent quality.

Rescue grass is a short-lived perennial, usually living 4 or 5 years under favorable conditions, but in the South behaving practically as a winter annual. It will withstand the winter as far north as Washington, D. C., and Lincoln, Nebr. Northward, however, the grass has never attained any agricultural importance (fig. 16).

This grass grows in tufts or bunches, often a foot in diameter and very leafy at the base. The stems are erect or nearly so, 2 to 4 feet high, and bear large open panicles. The large spikelets droop from the ends of long slender branches. On vigorous plants some panicles are a foot long.

Rescue grass is best adapted to humid regions with mild winters, springing up in the fall, growing through the winter, and maturing early in summer. In other



FIGURE 15.—Rescue grass (*Bromus catharticus* Vahl): 1, Part of plant, showing habit (about one-third natural size); 2, a single panicle (about one-half natural size); 3, spikelet (much enlarged); 4, a single floret (much enlarged).

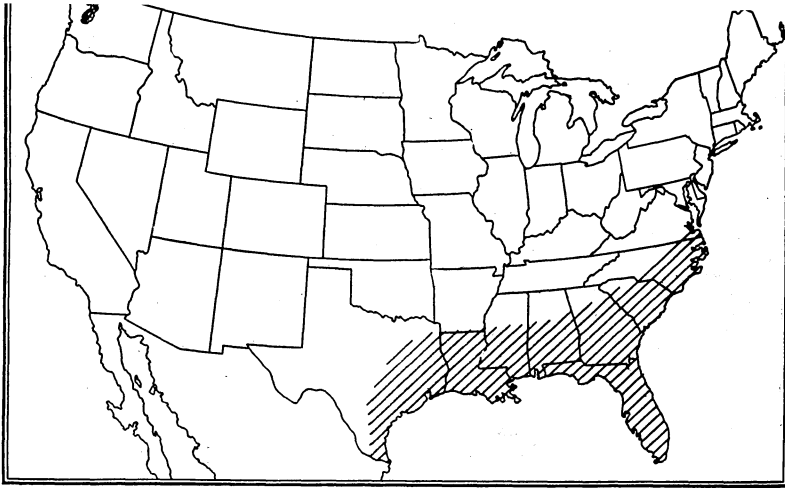


FIGURE 16.—Region of the United States in which rescue grass is most valuable.

words, it behaves as a winter annual in the regions where it is most valuable. It is distinctly a rich-land grass, growing vigorously on good soils but only meagerly on poor land. In view of these characteristics, rescue grass has proved more valuable as a winter crop on strong soils in the South and on the Pacific coast.

The grass is sometimes cut for hay, and under favorable conditions two cuttings may be obtained. More commonly, however, it is used as pasturage, producing more than either oats or rye on good soils. It is one of the most palatable of all pasture grasses. Close grazing is not advisable, as, like nearly all bunchgrasses, it is killed out by such treatment.

Rescue grass is best sown in the fall when cool weather begins. If sown alone

on prepared land, from 20 to 50 pounds per acre are used. In Australia, mixtures with alfalfa or red clover or Italian ryegrass are said to give excellent results. In Texas, bur-clover has been used mixed with rescue grass to good advantage. If the grass is allowed to mature seed late in the season and is then plowed under, a summer crop of cowpeas or Japan clover may be grown, after which a good volunteer crop of rescue grass appears. Even on permanent pastures, rescue grass volunteers well if it is allowed to mature some seed. On river-bottom lands subject to floods, rescue grass maintains itself very well.

The seeds of rescue grass are large, nearly equal to oats in size. A bushel weighs 14 to 16 pounds.

CRESTED WHEATGRASS

Crested wheatgrass (*Agropyron cristatum* Gaertn.; fig. 17) is a native of the cold, dry plains of Russia and Siberia. It was effectively introduced into the United States in 1898 and is now recognized as one of the most valuable grasses in the northern Great Plains and in adjacent sections of Canada (fig. 18).

Crested wheatgrass is a long-lived perennial bunchgrass closely related to the slender wheatgrass (*A. pauciflorum*) and much like it in growth habits. It differs from the latter in being somewhat leafier and in its broader, more compact inflorescence. Both awned and awnless forms occur in crested wheat-

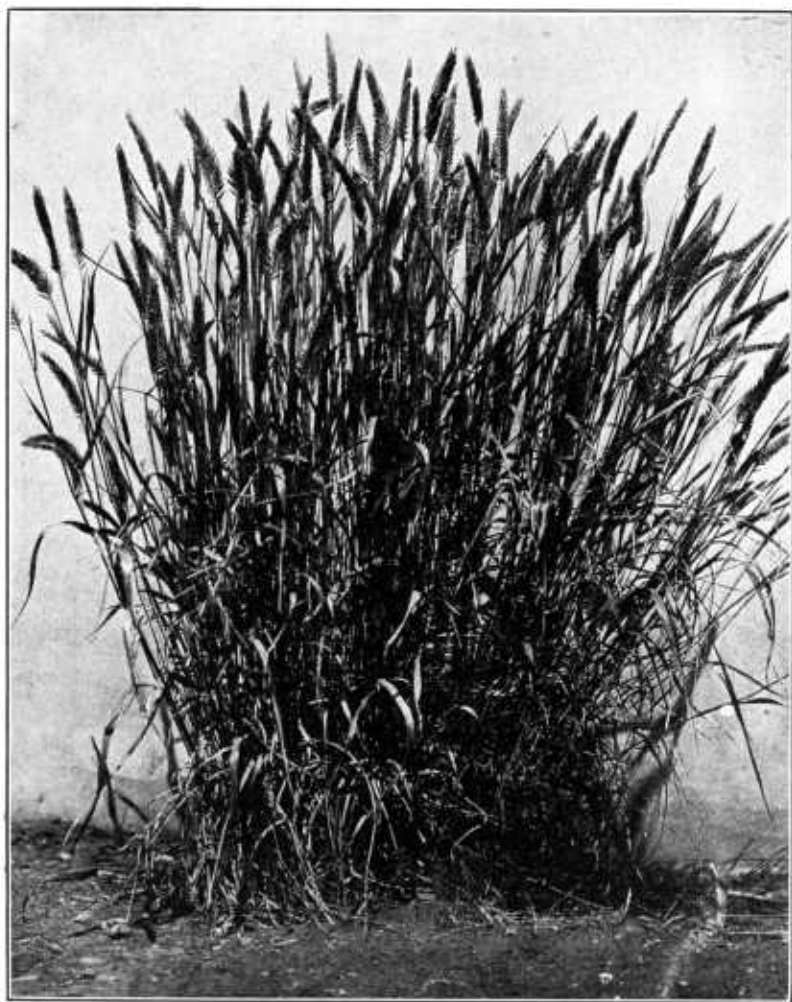


FIGURE 17.—Typical plant of crested wheatgrass (*Agropyron cristatum* Gaertn.).

grass. In drilled or broadcast seedings its growth resembles that of wheat, but in cultivated rows and in thin stands it is more distinctly bunchy. Ordinarily it reaches a height of 24 to 30 inches when mature.

Crested wheatgrass is markedly drought resistant and will endure almost any degree of cold. It is able to grow at lower temperatures than most grasses and therefore is one of the first to start growth in the spring and one of the latest to become dormant in the fall. During dry, hot summers growth ceases but is resumed as soon as soil moisture is re-

stored. It is an excellent hay grass, the yields under semiarid conditions ranging from half a ton to 1 ton per acre. This hay is both nutritious and palatable. It ranks equally high as a pasture grass, its long growing season providing both early spring and late fall grazing.

Seed weighing 20 to 24 pounds per bushel is produced in abundance, especially when the grass is grown in cultivated rows 36 to 42 inches apart. The seeding rates advised are 10 to 12 pounds per acre in close drills and 3 to 5 pounds per acre in rows.

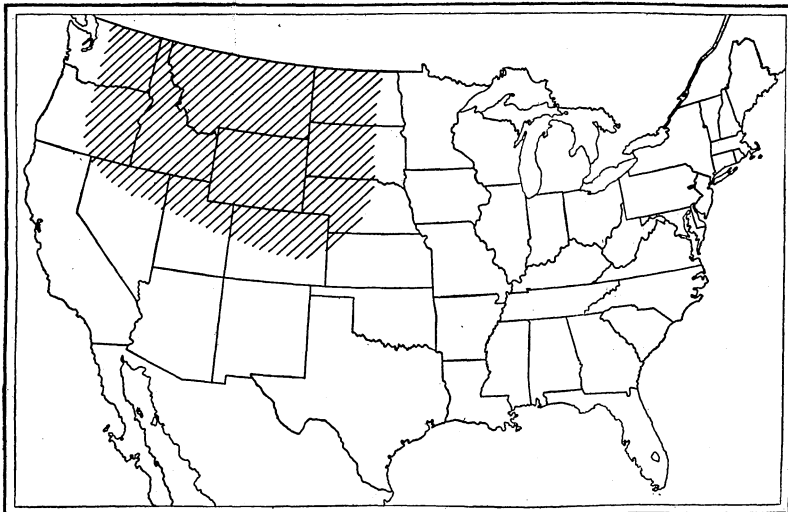


FIGURE 18.—Region in the United States in which crested wheatgrass is most valuable.

VASEY GRASS

Vasey grass (*Paspalum urvillei* Steudel, *Paspalum larranagai* Arech.; fig. 19) is a near relative of Dallis grass (*Paspalum dilatatum*), and, like it, is a native of the Argentina-Uruguay region. Accidentally introduced around New Orleans before 1882, the oldest specimens preserved were collected in that year, but it was probably introduced some years earlier. The grass has spread abundantly, especially on the more moist lands in Louisiana, eastern Texas, and southern Mississippi, but it occurs more or less now in the Coastal Plain region from North Carolina to Texas and also in California. It does not survive the winter at Washington, D. C. (fig. 20).

Vasey grass is an erect perennial, growing in tufts or bunches about a foot in diameter, with many erect leaf blades. The flowering culms are from 3 to 6 feet tall, each flower cluster bearing from 10 to 25 spikes. The flowers are very rarely attacked by the ergot so common on Dallis grass. The grass continues to produce flowering culms during a long season.

Where Vasey grass has become abundant much of it is cut for hay, and the quality of the hay is considered excellent. In pastures continuous heavy pasturing must be avoided, as like most of the

bunchgrasses Vasey grass is killed out by such treatment. Vasey grass continues to grow all winter, except in very cold weather, and therefore affords late pasturage.

There are but scant data with regard to the time and rate of sowing Vasey grass seed. It is probable that it is best sown at corn-planting time or later. The seed is light in weight, and 10 to 20 pounds per acre should give a satisfactory stand, depending on the quality of the seeds.

Vasey grass, like Dallis grass, is remarkable for its ability to grow in wet land and also to withstand very severe drought. It thrives best on heavy soils, but succeeds well on moist sandy land. The prospects are that it will become a grass of increasing agricultural importance.

From the general way in which Vasey grass has behaved without culture, it seems highly probable that it is destined to become a cultivated grass of considerable importance in the South. Much yet remains to be learned in regard to the best methods of culture, but it is likely to be used much after the manner of timothy in rotation with other crops.

Seed is produced in abundance by Vasey grass, but on the same plant every



FIGURE 19.—Vasey grass (*Paspalum urvillei* Steudel, *Paspalum larranagai* Arech.): 1, Plant, showing habit (about one-third natural size); 2 and 3, portions of branches, back and front view (enlarged); 4, a single spikelet, viewed from behind (much enlarged); 5, single spikelet, viewed from in front (much enlarged).

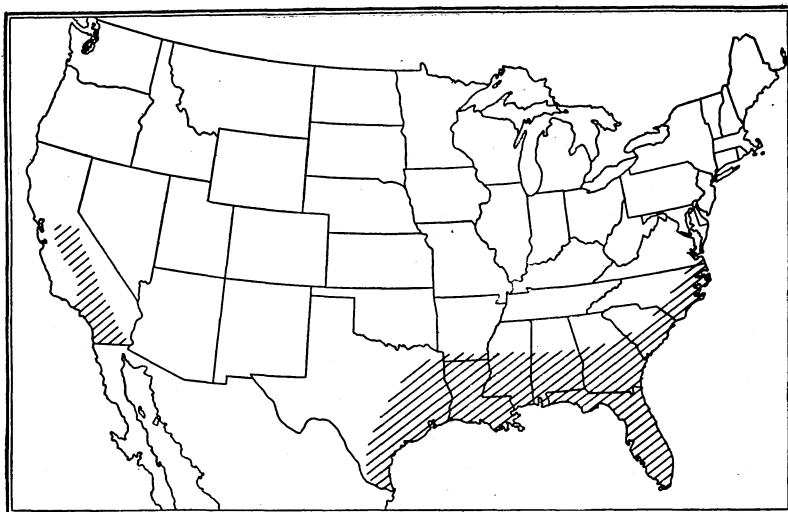


FIGURE 20.—Regions of the United States to which Vasey grass is well adapted.

stage from young flowers to ripe seed may be found at any time from June to November. In other words, the seed crop is never all ripe at one time. Apparently the best practice is to cut the first crop for hay and the second or last crop for

seed. By this procedure more of the seed is ripe at one time. If the seed is fully ripe when harvested it germinates well, but if cut earlier it must be well cured to secure satisfactory germination. Some commercial seed is now available.

BAHIA GRASS

Bahia grass (*Paspalum notatum* Fluegge; fig. 21) is a perennial grass that forms a dense sward of leaves and has flowering culms about 1 foot high, two-branched at the top. It is primarily a pasture grass. It is native from Cuba and Mexico southward to Argentina and has many local names. In western Cuba, where it is the common pasture grass, it is *cana mazo* (mat cane); in Costa Rica, *gengibrillo*; in Panama, ginger grass; in Argentina, *gramillon*, *pasto dulce*, *pasto manso*, and *gramilla blanca*. Portuguese names in Brazil and Paraguay are *graminha* and *capim de cabayu*. It is generally recognized as a very valuable pasture grass and an excellent turf former. The rootstocks are very stout, so that even on very sandy soil the grass makes a firm sod.

Bahia grass has proved hardy throughout Florida and as far north as McNeill, Miss. (fig. 22). It succeeds on nearly all types of soil, even on the sand hills, but does best in fairly firm soils.

The grass can easily be propagated by

division, and it produces seed abundantly throughout the warm season. Unfortunately, the seed for some obscure reason does not germinate well. This has proved true of seed from Cuba, from Florida, and from Costa Rica. Even when the seeds are decorticated or treated with sulfuric acid the germination is still low, usually below 10 percent. This difficulty with the seed is the principal impediment to the extensive culture of Bahia grass at present.

At the Florida Agricultural Experiment Station, Bahia grass is spreading year by year in spite of the apparently poor seed, even into land already occupied by other grasses. A firm seedbed seems desirable. In Florida the best germination has been obtained by sowing the seed in the latter part of May and in June.

The ergot that attacks Dallis grass and many other species of *Paspalum* also affects Bahia grass. Indeed, in parts of Argentina where the pastures are largely of this grass, the ergot causes a

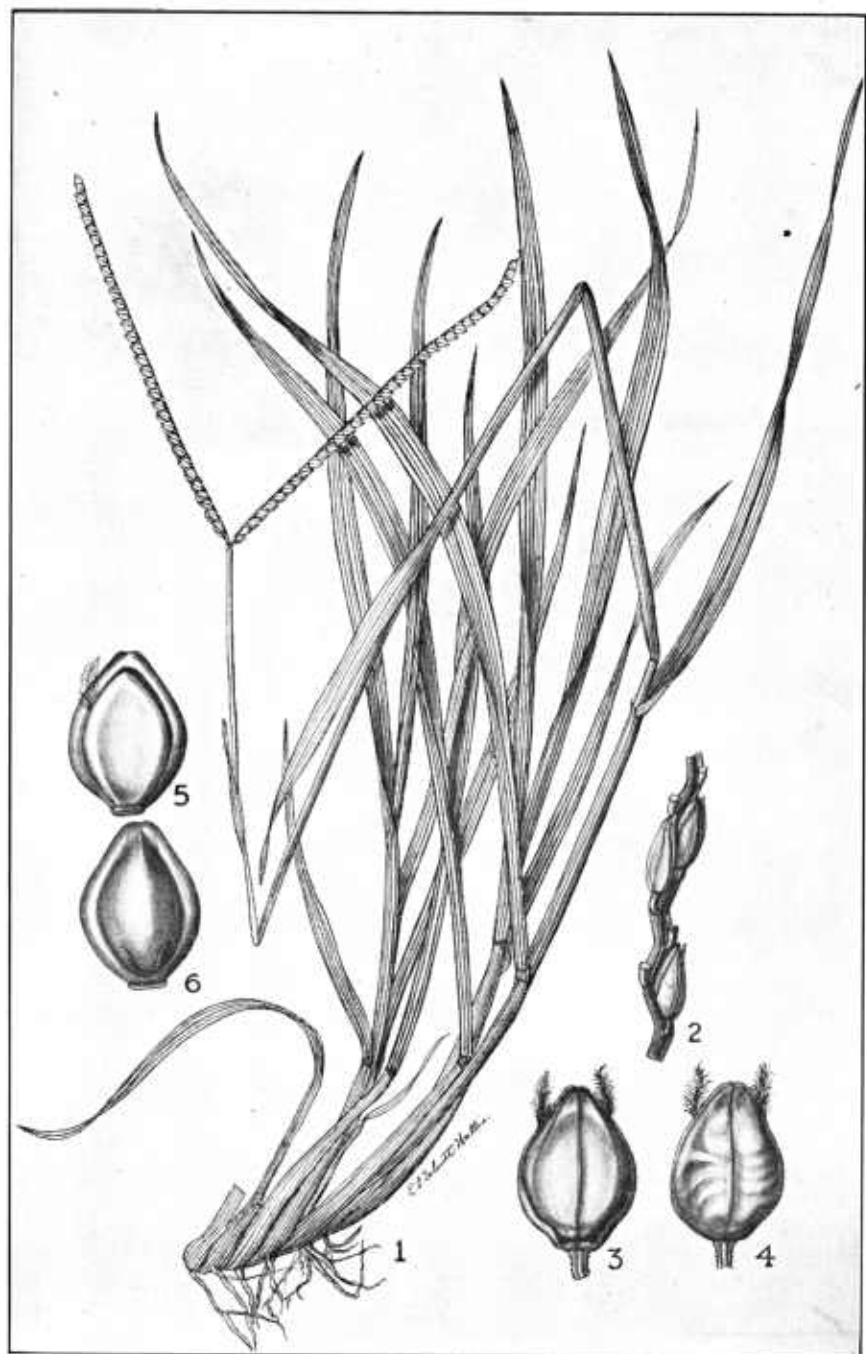


FIGURE 21.—Bahia Grass (*Paspalum notatum* Fluegge): 1, Part of plant, showing habit (about one-third natural size); 2, portion of spike, showing position of spikelets (enlarged); 3, front view of a single spikelet (much enlarged); 4, back view of a single spikelet (much enlarged); 5, front view of a single grain (much enlarged); 6, back view of a single grain (much enlarged).

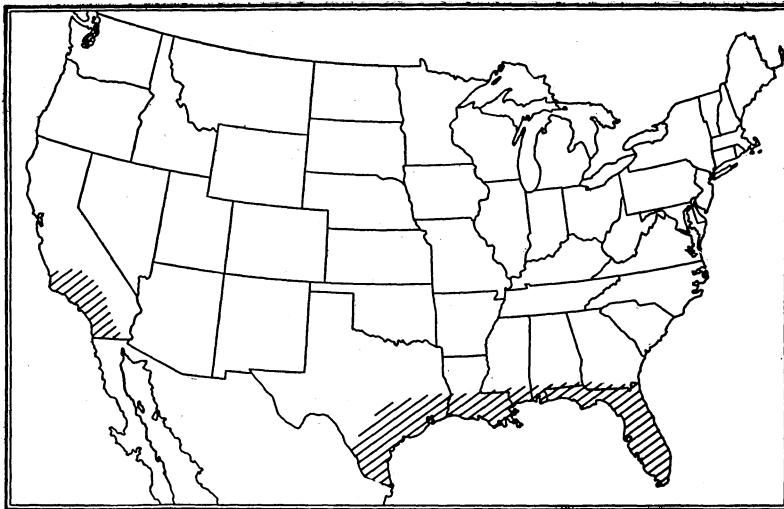


FIGURE 22.—Regions of the United States to which Bahia grass is adapted.

disease of cattle apparently the same as that caused by the same ergot on Dallis grass in Mississippi. It is not likely, however, that this ergot will ever be serious except perhaps in limited areas where Bahia grass or Dallis grass makes up

the whole pasture.

From the results already obtained it seems safe to prophesy that in time Bahia grass will occupy much of the area to which it is adapted and become a pasture plant of very high value.

MOLASSES GRASS

Molasses grass (*Melinis minutiflora* Beauvois; fig. 23) is also called gordura grass, stinkgrass, honey grass, and Ef-watakala grass. The Brazilian names for it are *capim mellado* (honey grass), *capim gordura* (fatgrass), and *catinguero* (stinkgrass). Two varieties are distinguished in Brazil, *catinguero roxo* with reddish flowers and *catinguero blanco* with pale flowers. The former is more common and more vigorous.

It is native to tropical Africa south of the Sahara, Madagascar, Ascension Island, and perhaps to Brazil, where it is abundant. The species is now cultivated in Australia, Hawaii, the Philippines, South Africa, the West Indies, and the United States (fig. 24).

It is a perennial, attaining a height of 3 to 4 feet. It is highly nutritious and the most esteemed of the pasture grasses of central Brazil, where it grows upon the hills and dry lands. The whole herbage is covered with hairs, which secrete a sweet, sticky substance with an odor like molasses. It is reputed that molasses-grass areas are free from mos-

quitoes, tsetse flies, ticks, and snakes, as they become repelled or killed by the sticky substance. Allowance should be made here for exaggeration.

Seed was first received by the United States Department of Agriculture in 1899, having been sent from Pernambuco by I. Nery da Fonseca. Distribution of the seed was made, and the results proved its adaptability to southern conditions, especially to Florida, where it thrives splendidly. It grows strong and rapidly covers the ground and is a summer pasture. It does not flower until the end of May, and this late-maturing habit seems to indicate that it is a promising hay grass for late cuttings. It sets seed well and volunteers freely in the southern half of Florida. Because of the peculiar odor of the grass cattle at first avoid it, but soon acquire a taste for it and then graze it eagerly.

Molasses grass is used both for pasture and for hay in Brazil. It is said to be best cut just before it blooms, as the numerous small awns on the florets are

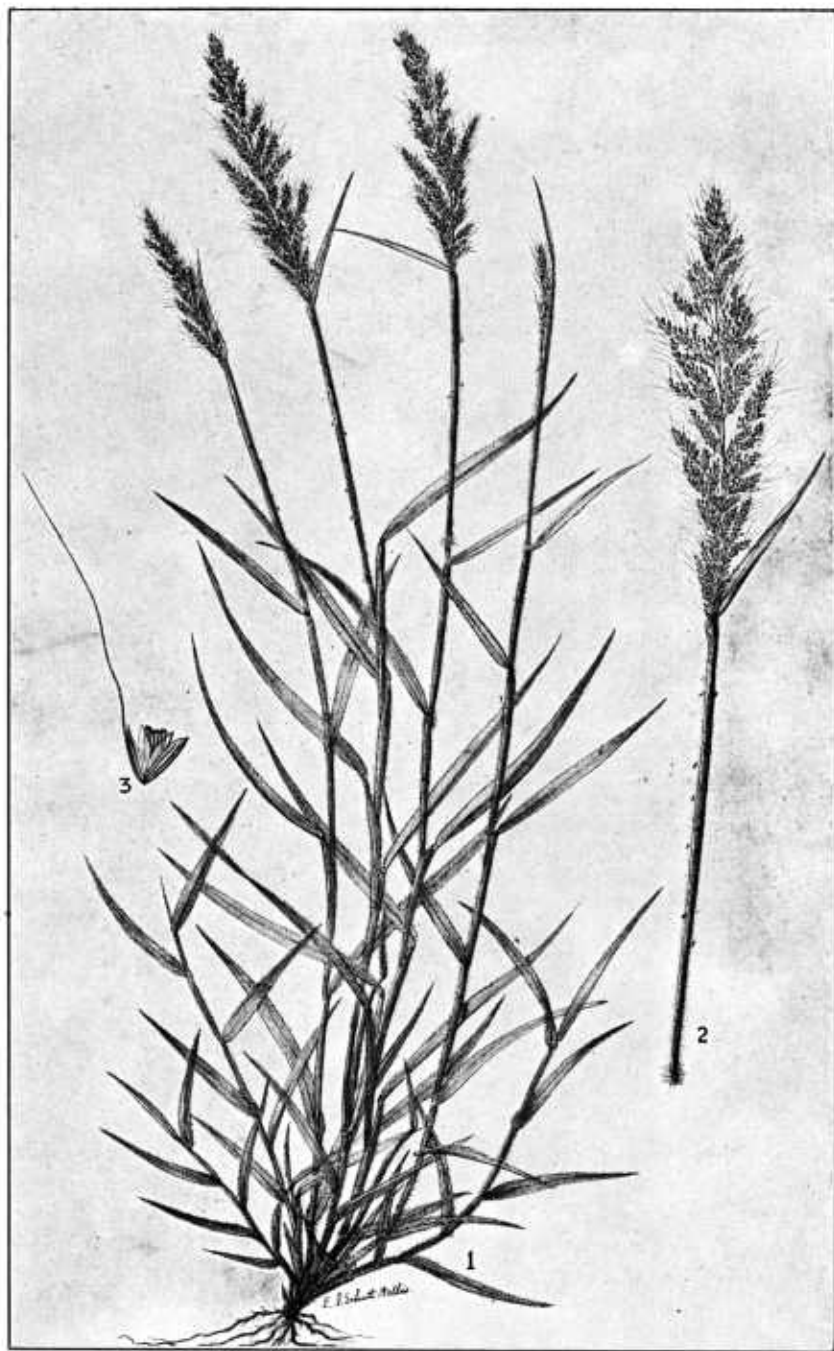


FIGURE 23.—Molasses grass (*Melinis minutiflora* Beauvois) : 1, Portion of a plant, showing habit (about one-fourth natural size) ; 2, a single panicle (somewhat reduced) ; 3, spikelet (enlarged).

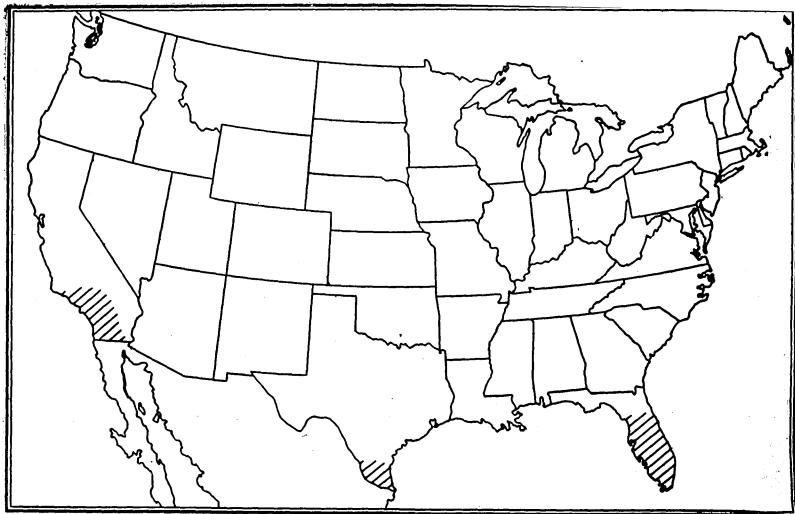


FIGURE 24.—Regions of the United States where molasses grass thrives.

disliked by cattle. The grass is also valuable in most tropical regions where it is introduced. In Florida on high sandy land 1 acre of molasses grass gave abundant pasturage for a cow and calf for the growing season. In Rhodesia $3\frac{1}{2}$

tons of hay per acre are recorded, and in Australia even higher yields.

At the present time the commercial seed supply all comes from Brazil. The seeds are very small and the weight per bushel light.

GUINEA GRASS

Guinea grass (*Panicum maximum* Linnaeus; fig. 26) is perhaps the most famous of all tropical grasses. It is native to Africa, but was early introduced into the West Indies incidental to the slave trade. In Jamaica it was introduced as early

as 1756 and even then called guinea grass. It now occurs generally in the Tropics and Subtropics. In the United States it is adapted only to a narrow strip from Florida to southern California (fig. 25).

Guinea grass thrives well only on heavy,

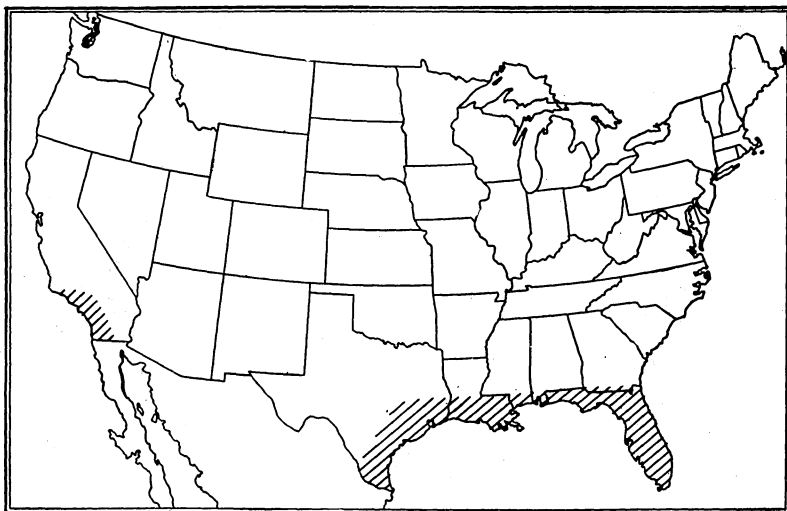


FIGURE 25.—Regions of the United States to which guinea grass is adapted.



FIGURE 26.—Guinea grass (*Panicum maximum* Linnaeus) : 1, Plant, showing habit (about one-eighth natural size) ; 2, a single panicle (about one-half natural size) ; 3, 4, and 5, different views of a spikelet (much enlarged).

usually rich soil. In Florida it has never become of much value on the sandy soils. In the West Indies and Central America it now occupies large areas. This is mostly on land that tends to grow up into brush and then forest. To keep the land in grass it is necessary to cut the brush every year or two and then burn in the dry season. This keeps down the brush and does not injure the grass.

Guinea grass is a long-lived perennial spreading by short underground branches. Single tufts are often 4 feet in diameter and 6 to 10 feet tall. The culms are stiff and erect, leafy for half the height. The panicles are broadly pyramidal, loose, and a foot or more long. The seed shatters rather promptly when ripe.

There are numerous forms of guinea grass, varying in breadth of leaves, height,

hairiness, etc. An important variety is the buffalo grass of South Africa (*Panicum maximum* var. *hirsutissimum*), quite hairy and with the lower branches lying on the ground and rooting at the nodes.

In the Tropics guinea grass is used mainly for pasture, but much is cut to be fed green. Six to eight cuttings can be made in a season if there is enough moisture. The grass has been used as hay and is eaten well even if coarse.

Some seed of guinea grass is harvested in Cuba. There is little demand for it, however, as where well adapted the grass spreads rapidly and continually reseeds new land. In the South it is an excellent grass to grow in 6-foot rows to use as a soiling crop. Napier grass, Japanese cane, and Guatemala grass, however, are even more valuable.

TEOSINTE

Teosinte (*Euchlaena mexicana* Schrad., *E. luxurians* Durieu and Ascherson; fig. 28) is a coarse annual grass, growing 6 to 12 feet high, usually producing many stems to each plant. It is a native of tropical America and probably of ancient cultivation. It is the nearest existing relative of Indian corn, with which it readily produces hybrids.

Teosinte was at one time extravagantly advertised as a producer of enormous crops of fodder. Under favorable cir-

cumstances, such as rich soil, ample moisture, and a long hot season, very large yields have been obtained, namely, 20 to 50 tons of green forage per acre. In spite of its large yield under favorable conditions, teosinte has never become of much importance in any country. On medium and poor soils better results are obtained with other coarse grasses, as sorghum, Japanese sugar cane, and Napier grass.

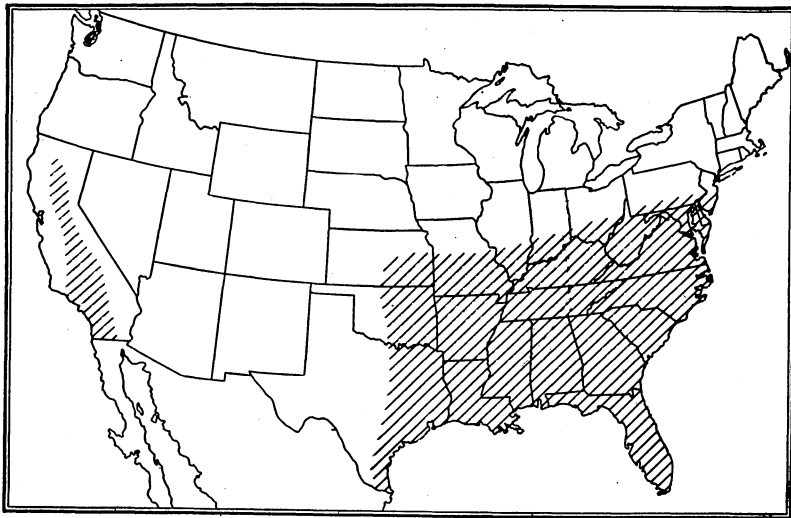


FIGURE 27.—Regions of the United States in which teosinte may be grown.



FIGURE 28.—Teosinte (*Euchlaena mexicana* Schrader, *E. luxurians* Durien and Ascherson) :
 1, Plant, showing habit (about one-twelfth natural size) ; 2, a branch showing the staminate panicle at the tip and the pistillate or fertile ear in the axil of each upper leaf ; 3, an ear (slightly enlarged) ; 4, four grains each with its long feathery stigma (enlarged) ; 5 and 6, different views of the mature grain.

Teosinte is cultivated much after the manner of corn, but the plants tiller abundantly, so the hills are planted 4 to 5 feet apart each way or in rows 5 feet apart with plants spaced about 3 feet in the row. If allowed to mature, only one crop can be cut in a season, but if cut when 5 feet high, another cutting of the same yield may be expected.

The plant matures seed only in the extreme South. Good crops have been grown as far north as Kansas and Vir-

ginia. In Kansas the average yield for 3 years was nearly 24 tons per acre (fig. 27).

The crop may be utilized green, as silage, and as fodder. The fodder is rather difficult to cure. Animals readily eat the plant green or dried, but no exact feeding experiments are of record. The patent fact that teosinte has never won lasting favor with farmers can only mean that it is not so desirable as other similar crops.

VELVET GRASS

Velvet grass (*Holcus lanatus* Linnaeus, *Notholcus lanatus* Nash; fig. 30) is a native of Europe early introduced into America. It now occurs over the northern half of the United States in humid regions from coast to coast. In England it is known as Yorkshire fog, or meadow softgrass, and by various other names; on the northern Pacific coast, where it is now very abundant, the grass is called mesquite.

Velvet grass is a hardy, long-lived, perennial bunchgrass. The whole plant is pale and very hairy, and it is perhaps due to its hairiness that it is not particularly palatable to cattle. The grass possesses but little substance, so that the hay yields are much smaller than the crop would seem to promise. Under favor-

able conditions two cuttings may be obtained in a season. In meadows each plant tends to make a bunch a foot or two in diameter, but in pastures and lawns it spreads by short underground branches. In lawns a single plant may in time cover a space 3 feet in diameter. Correlated with this habit the grass will withstand continuous mowing or grazing. As a lawn grass it is not desirable on account of its pale color, but on the Pacific coast it always invades lawns if given a chance (fig. 29).

Velvet grass cannot be considered a first-class hay grass, but in regions where it crowds out other grasses it is perhaps better to utilize it than to attempt to kill it out. Thus, in the moist region along the Pacific coast it crowds

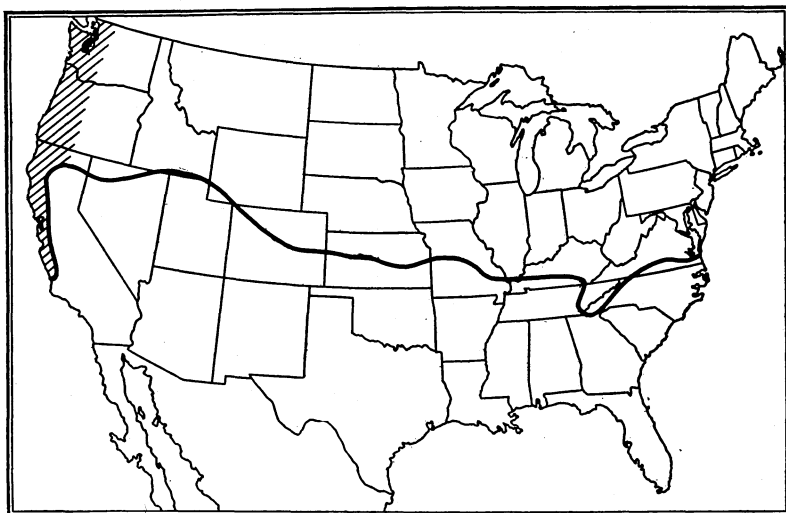


FIGURE 29.—Region of the United States where velvet grass occurs (north of line shown). It is best adapted to the shaded area.

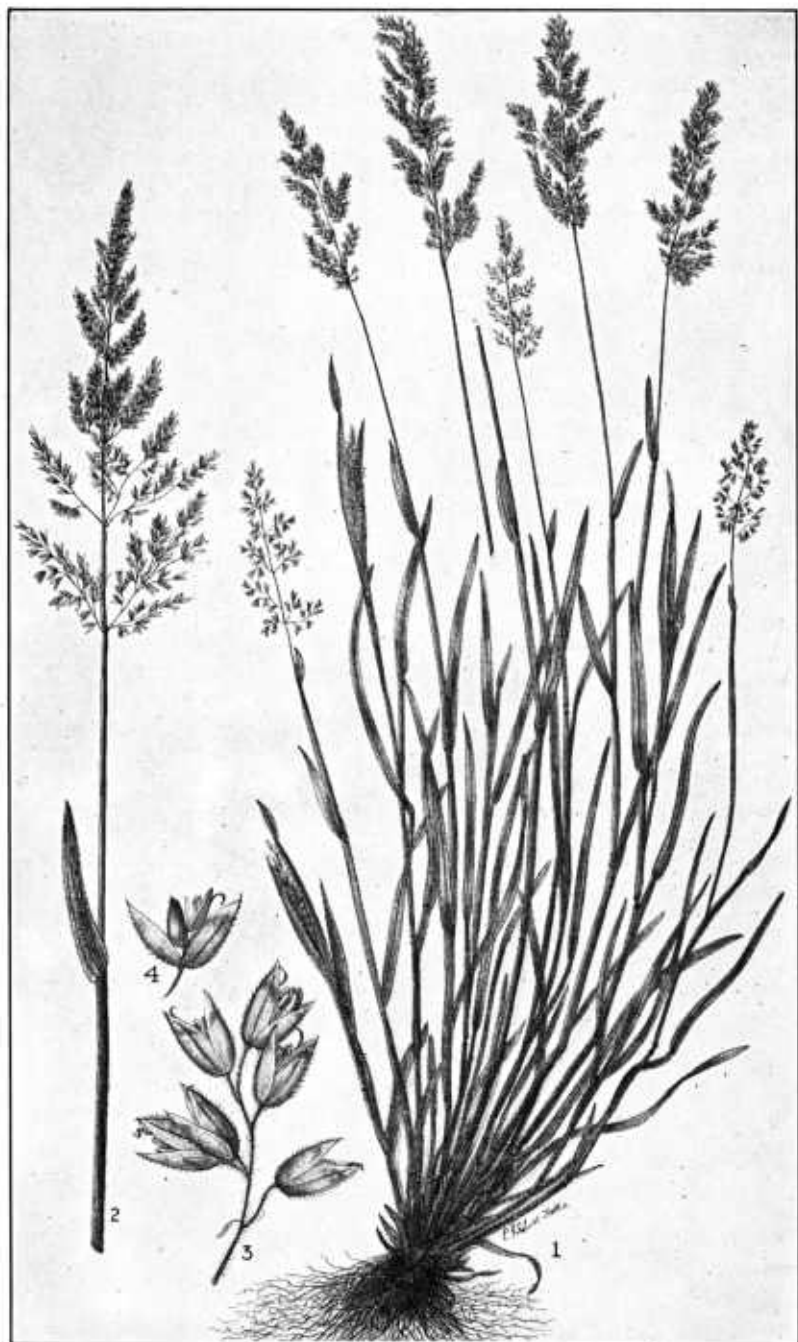


FIGURE 30.—Velvet grass (*Holcus lanatus* Linnaeus, *Notholcus lanatus* Nash): 1, Plant, showing habit (about one-fourth natural size); 2, a single panicle (about natural size); 3, a branch with six spikelets (much enlarged); 4, a single spikelet (much enlarged).

out most other grasses, and therefore except on the better lands it is more economical to use it for hay and pasturage than to attempt to grow other grasses. It is best cut for hay when in full bloom, at which time the branches of the panicle are spreading; later they close up and become erect.

Commercial seed of velvet grass is mostly produced in Denmark and New Zealand. The latter is usually better in

quality. In seeding, 20 pounds per acre is usually recommended.

When it is desirable to eradicate velvet grass, it should be cut for hay when in full bloom before the seed is developed enough to grow. Beginning about July 1, the grass should be plowed or disked shallow. During the dry weather the field requires disking frequently, so that the grass will be killed. Then the field may be seeded in early fall to whatever crop is desirable.

SWEET VERNALGRASS

Sweet vernalgrass (*Anthoxanthum odoratum* Linnaeus; fig. 32) is native to most parts of Europe, northern Asia, and northwest Africa. It was early introduced into North America and now occurs as a naturalized grass in Canada and the United States across the continent and southward to the Cotton Belt (fig. 31). The grass is highly variable, and several of the more marked forms have received botanical names in Europe.

Sweet vernalgrass receives its name partly because it blooms early and partly because the whole plant contains coumarin, which gives it a vanillalike odor and a bitter taste. This is present even in seedlings, which can be recognized by their odor. Many European writers have recommended that this species be included in grass mixtures to give a sweet odor to the hay. It is very doubtful, however, whether this is any real advantage.

The grass is a long-lived perennial and forms dense circular tufts. The flowering culms are erect, usually 12 to 24 inches high, but sometimes taller. It is one of the earliest grasses to appear in spring and is often abundant in pastures on poor soil. Cattle will graze on the grass but do not devour it eagerly. Its chief merits are its earliness and its ability to thrive on very poor soils. For the latter reason it is not undesirable in a mixture of other plants to form turf. It prefers well-drained soils, but will thrive in wet lands, even in peat, and apparently is indifferent to lime in the soil.

While sweet vernalgrass is abundant and very well adapted to extensive regions in America, it can scarcely be called a cultivated grass. This is due to its small growth and relative unpalatability. Its greatest virtue is its ability to grow on soils where few other equally good

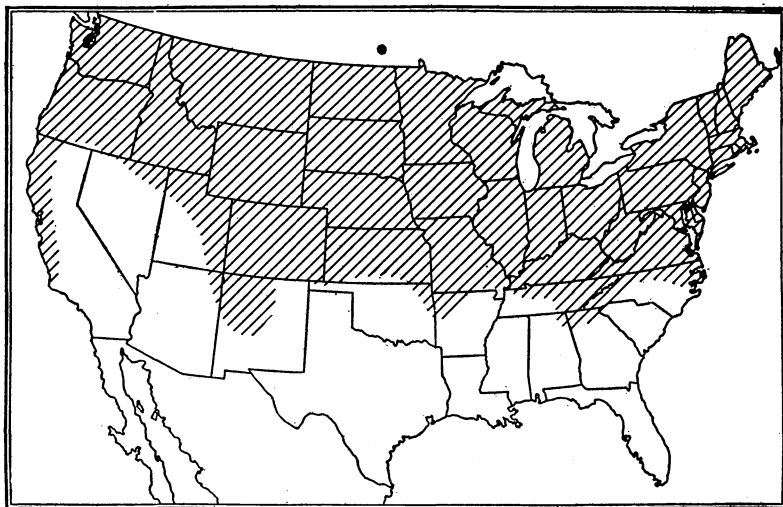


FIGURE 31.—Region of the United States to which sweet vernalgrass is adapted.

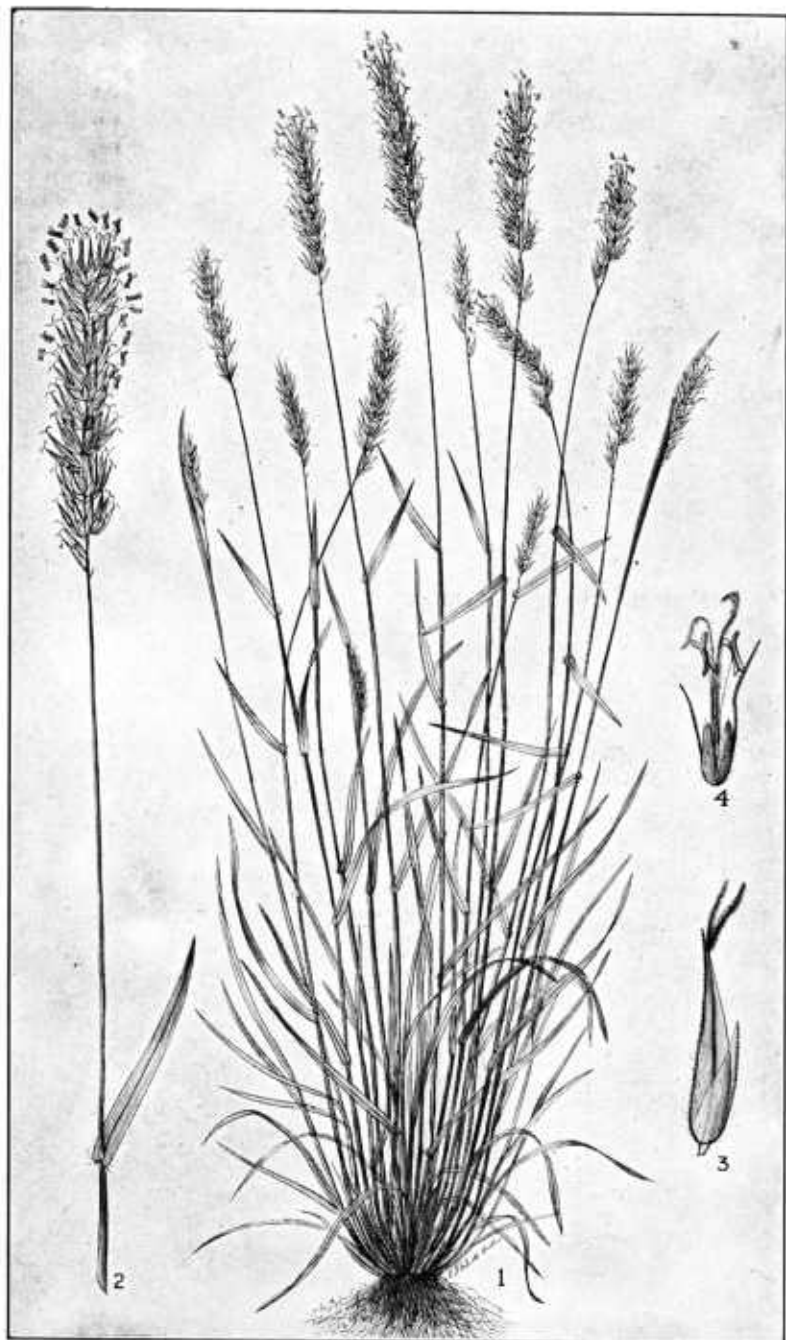


FIGURE 32.—Sweet vernalgrass (*Anthoxanthum odoratum* Linnaeus) : 1, Plant, showing habit (about one-third natural size) ; 2, a panicle (about natural size) ; 3, a spikelet (much enlarged) ; 4, a single floret (much enlarged).

grasses will thrive. In New Zealand, where it is very abundant, it is considered detrimental because it replaces better grasses. In England it has been reputed to give a fine flavor to mutton, and in Norway the same is said in regard to venison.

Commercial seed comes from Europe and not infrequently has been adulterated with the annual sweet vernalgrass (*Anthoxanthum puellii*). The seed is light in weight, about 10 pounds to the bushel. A pound contains on the average 924,000 seeds.

MEADOW FOXTAIL

Meadow foxtail (*Alopecurus pratensis* Linnaeus; fig. 34) is a native of the temperate parts of Europe and Asia. It has been cultivated since 1750 and is grown in Europe to a considerable extent, especially as a hay grass for rich, rather wet lands. In North America it has never attained great importance, but is grown to some extent in mixtures for wet lands in the northernmost States and in eastern Canada (fig. 33).

Meadow foxtail is a long-lived perennial grass. The underground branches are short, so that the grass is in loose tufts. The flowering stems are erect and usually about 3 feet high, and the head is much like that of timothy. It begins growth very early in the spring; indeed, it is about the earliest of all cultivated grasses. Under favorable conditions two cuttings may be obtained in a season, and very rarely three. It is best cut when in

full bloom. At this time the stems are very sweet, containing more sugar than most other grasses. Yields have been reported from northern Michigan and from Ontario of 1½ tons per acre.

The grass is essentially a lover of wet land, but it does not thrive where the moisture is stagnant. On overflowed lands it succeeds well. It resists extreme winter cold, and even after growth has begun in spring it endures frost well. Unlike most grasses it makes good growth in the shade.

The seed of meadow foxtail is produced in Finland, Sweden, Denmark, Holland, and New Zealand, most of the imported seed coming from the first-named country. A bushel weighs from 6 to 12 pounds. As a rule it is sown at the rate of 20 pounds per acre. A pound, depending on quality, contains from 500,000 to 1,000,000 seeds.

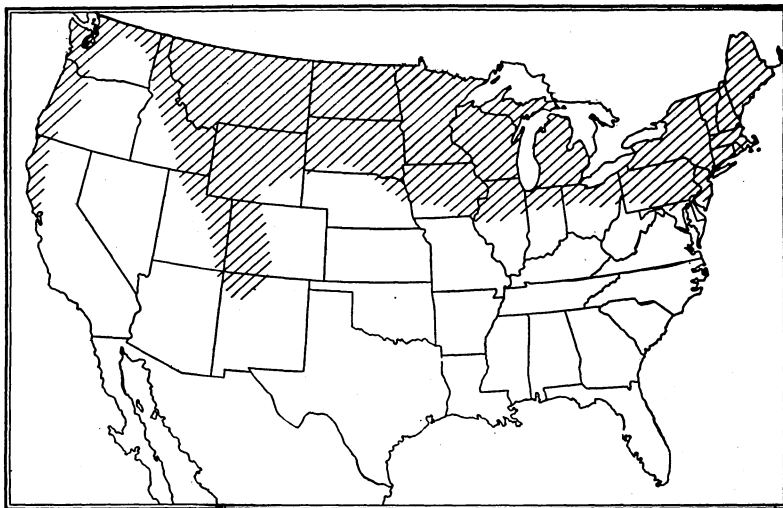


FIGURE 33.—Region of the United States in which meadow foxtail may be grown. It does best in the Northern States.



FIGURE 34.—Meadow foxtail (*Alopecurus pratensis* Linnaeus): 1, Portion of plant, showing habit (about one-fourth natural size); 2, a single spike (about natural size); 3, a spikelet (much enlarged).



FIGURE 35.—Canary grass (*Phalaris canariensis* Linnaeus) : 1, Plant, showing habit (about one-fifth natural size) ; 2, a spike (about natural size) ; 3, spikelet (much enlarged) ; 4, a floret (much enlarged).

CANARY GRASS

Canary grass (*Phalaris canariensis* Linnaeus; fig. 35) is an annual native to the countries about the Mediterranean Sea. Its name doubtless comes from the fact that its seed is the favorite feed for canary birds, as the grass is probably not native on the Canary Islands.

Canary grass is cultivated much after the manner of barley, the seed being sown in the fall in regions of mild winters and in the spring farther northward. The stems are from 3 to 4½ feet tall and usually many are on a single plant. The grass is easily known by its egg-shaped head, about 1 inch long, and the green and white striped glumes.

While the grass is excellent for a hay plant, it is usually cultivated wholly for the seed. Most of the seed is at present imported, mainly from the eastern Mediterranean countries. Excellent crops, however, can be produced in North America. In California it has averaged 10 bushels of seed, and in Saskatchewan nearly 30 bushels have been produced per acre (fig. 36).

In growing the crop it would be safe to use exactly the same methods as used for barley. While the seed has been used for human food, its main present use is as bird seed. As a hay plant it has no apparent advantage over the small grains.

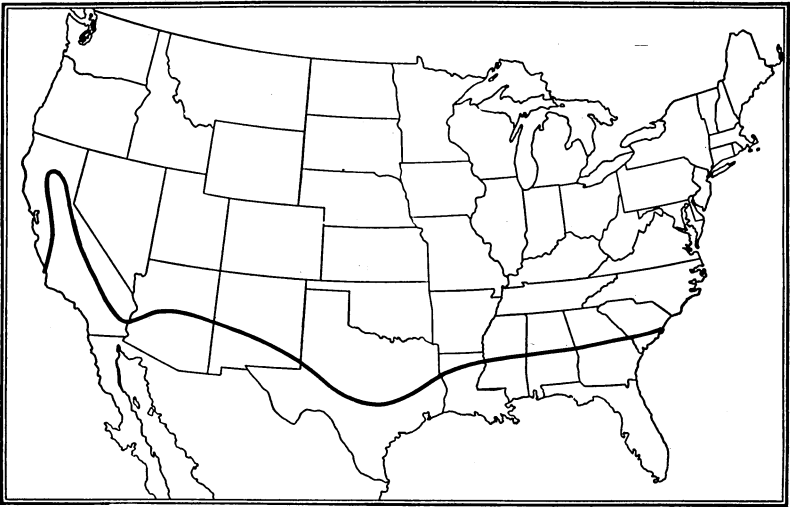


FIGURE 36.—North of the line shown canary grass must be sown in the United States in spring; south of the line, in fall.

NATAL GRASS

Natal grass (*Tricholaena rosea* Nees; fig. 38) is native to much of South Africa. Owing to its beauty it was first cultivated as an ornamental and was thus grown in the United States as early as 1866. The beautiful rosy panicles make Natal grass highly attractive. It became accidentally introduced about 1875 at Reddick, Fla., and by 1884 had spread over large areas about that town. It is now abundant over the southern half of Florida, especially in well-drained sandy lands (fig. 37). The extreme beauty of the fields in bloom

impresses every tourist, and perhaps no other experience creates so vivid a remembrance.

About 1910 Natal grass was much advertised as a hay grass for Florida, and many large fields were established. From then it spread rapidly, so that at the present time it is the principal grass over large areas of uncultivated land and practically the only herbaceous plant in citrus groves.

Natal grass is a perennial, but where the winter temperature falls to about

18° F. the plants are killed; an abundant new crop comes from the scattered seeds. The grass is remarkable for its ability to grow well on high, dry sand hills.

Under favorable conditions three crops of hay can be cut in a season, but the grass is light in weight, so that the total yield is rarely as much as 2 tons per acre. It is best to cut in early bloom when the flowers are of a bright-rose color. After these begin to fade the quality of the hay deteriorates.

Once established Natal grass perpetuates itself indefinitely. Perhaps the best method of culture is in rotation with a winter crop, and after this is harvested the grass volunteers abundantly.

Except as a purely summer crop, Natal grass is well adapted only to Florida, southern Texas, a narrow strip along the Gulf coast, and southern California. It now occurs generally in all tropical and subtropical regions, but its special value is on poor, sandy soils.

A single plant of Natal grass may form a tuft 2 to 3 feet in diameter with flowering culms 2 to 4 feet high. The outer culms soon become decumbent at the base, while the central ones are erect or nearly erect. The culms branch at the base, so that new ones constantly appear. Owing partly to this character Natal grass is an everbloomer; that is, it produces flowers from late spring until killed by frost.

The rosy panicles resemble in shape and size those of oats. They are of a beautiful rosy color, for which reason the grass has also been called Australian redtop and Hawaiian redtop. There are several varieties, one of which has very pale, nearly white, flowers.

Besides its use as a hay crop, Natal grass furnishes good pasturage, and cattle eat it readily, especially if it is kept closely grazed. It is sometimes objected to in citrus groves because it increases the cultivation necessary and in dry seasons consumes much of the soil moisture. It is certainly better, however, than the sand spurs and Spanish needles that formerly covered the ground even in citrus groves. In the pineapple district Natal grass has acquired a special value. After some years pineapple plants become badly injured by root nematodes. If the land is then put into Natal grass for a time the nematodes are destroyed because they cannot live on the grass roots. The field can then again be planted to pineapples.

Natal grass seed is produced in Australia and Florida. A bushel weighs about 7 pounds. In sowing on new land 8 to 10 pounds per acre will give a good stand, but if less is used the grass will in a short time produce enough seed for it to occupy the land.

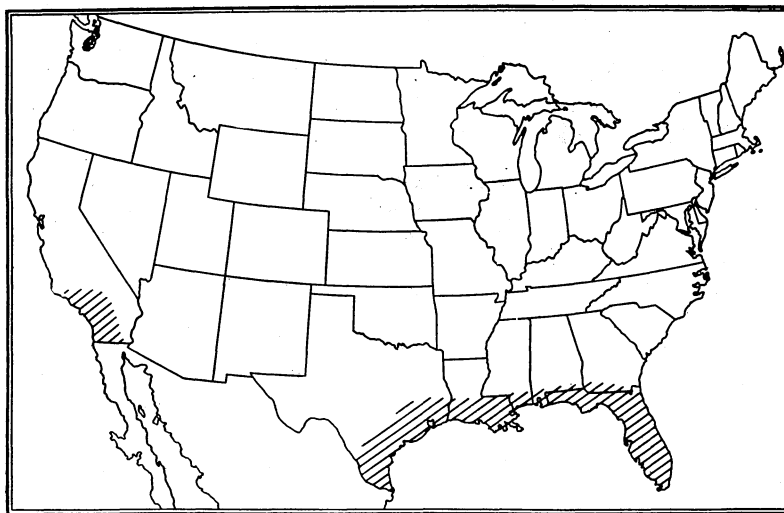


FIGURE 37.—Regions of the United States where Natal grass will thrive.



FIGURE 38.—Natal grass (*Tricholucna rosca* Nees): 1, Plant, showing habit (one-sixth natural size); 2, a panicle (about one-third natural size); 3, spikelet (about natural size).

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